WE CLAIM:

1. A device for automated composite lay-up, comprising:

a tool having an axis of rotation and an outside mold surface on an inside of a mandrel; and

a circular ring surrounding said tool and said mandrel and concentric with said axis of rotation wherein said tool is rotated about said axis of rotation and composite material is delivered directly to said outside mold surface on the inside of said mandrel.

2. The device of claim 1, further comprising:

a bearing that contacts said circular ring and supports rotation of said mandrel about said axis of rotation; and

a bearing cradle that holds said bearing and supports the weight of said mandrel.

3. The device of claim 1, further comprising:

a gantry beam disposed to access the inside of said mandrel.

4. The device of claim 1, further comprising:

a connecting mechanism connecting a material delivery head to a gantry beam and providing axial motion of said material delivery head along said gantry beam.

5. The device of claim 1, further comprising:

an arm mechanism connecting a material delivery head to a gantry beam and providing motion of said material delivery head relative to said outside mold surface of said mandrel.

6. The device of claim 3, wherein said gantry beam is supported as a

cantilever beam.

7. The device of claim 3, wherein said gantry beam is supported as a cantilever beam using rollers so that said gantry beam is moveable relative to said tool.

8. The device of claim 3, further comprising:

a tail stock wherein said gantry beam is supported at one end by said tail stock.

9. A device for automated composite lay-up, comprising:

a tool including a mandrel, wherein said mandrel has an interior mandrel surface that conforms to an outside mold line of a part;

at least one circular ring attached to said tool wherein said circular ring surrounds said tool and said mandrel; and

a bearing that contacts said circular ring wherein said circular ring rotates supported by said bearing so that said tool and said mandrel rotate concentrically with said circular ring about an axis of rotation passing through the center of said circular ring.

10. The device of claim 9, further comprising:

a material delivery head supported above said interior mandrel surface wherein composite material is delivered directly to said outside mold line on said interior mandrel surface.

11. The device of claim 9, further comprising:

a bearing cradle that holds said bearing and supports the weight of said tool.

12. The device of claim 10, further comprising:

a gantry beam that supports said material delivery head inside of said mandrel.

13. The device of claim 9, further comprising:

a connecting mechanism connecting a material delivery head to a gantry beam, wherein:

said connecting mechanism provides axial motion of said material delivery head relative to said interior mandrel surface.

14. The device of claim 9, further comprising:

an arm mechanism connecting a material delivery head to said gantry beam, wherein:

said arm mechanism provides motion of said material delivery head relative to said interior mandrel surface in a direction normal to said interior mandrel surface; and

said arm mechanism provides rotation of said material delivery head relative to said interior mandrel surface about an axis normal to said interior mandrel surface.

15. A device for automated composite lay-up, comprising:

a tool including a mandrel and a circular ring having a center, wherein:

said mandrel has an interior mandrel surface that conforms to an outside mold line of a part:;

said circular ring surrounds said mandrel and is attached to said mandrel; and

a bearing cradle including a plurality of bearings wherein:

at least one bearing of said plurality of bearings contacts said circular ring;

said bearing cradle supports the weight of said tool through said plurality of bearings;

said circular ring rotates supported by said bearing so that said mandrel rotates concentrically with said circular ring about an axis of rotation passing through the center of said circular ring.

16. The device of claim 15, further comprising:

a gantry beam that is cantilever supported, wherein:

said gantry beam is moveable relative to said tool; and

said gantry beam supports a material delivery head inside said interior mandrel surface of said mandrel.

17. The device of claim 15, further comprising:

a connecting mechanism connecting a material delivery head to a gantry beam, wherein:

said connecting mechanism provides axial motion of said material delivery head relative to said interior mandrel surface;

said connecting mechanism provides motion of said material delivery head relative to said interior mandrel surface in a direction normal to said interior mandrel surface; and

said connecting mechanism provides rotation of said material delivery head relative to said interior mandrel surface about an axis normal to said interior mandrel surface.

18. The device of claim 15, further comprising:

an arm mechanism connecting said material delivery head to said gantry beam, wherein:

said arm mechanism provides axial motion of said material delivery head relative to said interior mandrel surface

said arm mechanism provides motion of said material delivery head relative to said interior mandrel surface in a direction normal to said interior mandrel surface; and

said arm mechanism provides rotation of said material delivery head relative to said interior mandrel surface about an axis normal to said interior mandrel surface.

19. The device of claim 15 wherein said bearing cradle is moveable:

20. The device of claim 15, further comprising:

a hub attached to said tool and rotationally supporting said tool so that said mandrel rotates about an axis of rotation passing through said hub and the center of said circular ring.

21. The device of claim 15, further comprising:

a tail stock wherein said gantry beam is supported at one end by said tail stock during operation of said material delivery head.

22. The device of claim 15, further comprising:

a material delivery head supported above said interior mandrel surface wherein composite material is delivered directly to said outside mold

line on said interior mandrel surface.

23. An aircraft part manufacturing device for automated composite lay up, comprising:

a tool including a mandrel and a circular ring having a center, wherein:

said mandrel has an interior mandrel surface that conforms to an outside mold line of a part:;

said circular ring surrounds said mandrel and is attached to said mandrel;

a bearing cradle including a plurality of bearings wherein:

at least one bearing of said plurality of bearings contacts said circular ring;

said bearing cradle supports the weight of said tool through said plurality of bearings;

said circular ring rotates supported by said bearing so that said mandrel rotates concentrically with said circular ring about an axis of rotation passing through the center of said circular ring;

said bearing cradle is moveable;

a material delivery head that delivers composite material directly to said outside mold line on said interior mandrel surface;

a gantry beam that is cantilever supported, wherein:

said gantry beam is moveable relative to said tool; and

said gantry beam supports said material delivery head inside said interior mandrel surface of said mandrel; and

a connecting mechanism connecting said material delivery head to said gantry beam, wherein:

said connecting mechanism provides axial motion of said material delivery head relative to said interior mandrel surface;

said connecting mechanism provides motion of said

material delivery head relative to said interior mandrel surface in a direction normal to said interior mandrel surface;

said connecting mechanism provides rotation of said material delivery head relative to said interior mandrel surface about an axis normal to said interior mandrel surface.

24. An aircraft part manufacturing device for automated composite lay up, comprising:

means for rotating a mandrel about an axis of rotation wherein said mandrel has an outside mold surface on the inside of said mandrel;

means for supporting a material delivery head above said outside mold surface; and

means for placing a composite fiber material inside said mandrel onto said outside mold surface.

25. The device of claim 24 wherein said means for rotating said mandrel further comprises means for supporting said mandrel on a bearing in contact with a circular ring surrounding said mandrel.

26. The device of claim 24 wherein said means for supporting a material delivery head further comprises:

means for supporting said material delivery head from a gantry beam; and

means for providing axial motion of said material delivery head along said gantry beam.

27. The device of claim 24 wherein said means for supporting a material delivery head further comprises:

means for providing motion of said material delivery head relative to said outside mold surface in a direction normal to said outside mold surface;

and

means for providing rotation of said material delivery head relative to said outside mold surface about an axis normal to said outside mold surface.

28. A method for automated composite lay up on an interior mandrel surface of a tool having an axis of rotation, comprising steps of:

rotating a mandrel about the axis of rotation wherein said mandrel has an outside mold surface on the inside of said mandrel;

supporting a material delivery head above said outside mold surface; and

placing a composite fiber material inside said mandrel onto said outside mold surface.

29. The method of claim 28 wherein said rotating step further comprises supporting said mandrel on a bearing in contact with a circular ring surrounding said mandrel.

30. The method of claim 28 wherein said rotating step further comprises:

supporting said mandrel on a bearing in contact with a circular ring surrounding said mandrel; and

supporting said bearing in a bearing cradle so that said bearing cradle supports the weight of said mandrel, the tool, and said circular ring.

31. The method of claim 28 wherein said supporting step further comprises:

supporting said material delivery head from a gantry beam; and

providing axial motion of said material delivery head along said gantry beam.

32. The method of claim 28 wherein said supporting step further comprises:

providing motion of said material delivery head relative to said outside mold surface in a direction normal to said outside mold surface; and

providing rotation of said material delivery head relative to said outside mold surface about an axis normal to said outside mold surface.

33. The method of claim 28 wherein said supporting step further comprises:

supporting said material delivery head from a gantry beam; and

supporting at least one end of said gantry beam using a tail stock.